United States Patent [19]

Piegza

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[54] **PRESSURE VESSEL**

[75] Inventor: **Henry J. Piegza,** Clarence, N.Y.

[73] Assignee: **WSF Industries, Inc.,** Tonawanda, N.Y.

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[52] **U.S. Cl.** ..... **220/46 R,** 74/18.2, 220/40 R, 285/24

[51] **Int. Cl.** **B65d 87/06,** F16j 15/50

[58] **Field of Search** ..... 220/15, 40 R, 40 S, 46 R; 23/290; 21/66, 94, 95, 96, 97, 98, 99; 219/44; 74/18.2; 285/24

[56] **References Cited**

UNITED STATES PATENTS

3,352,028	11/1967	Richman	220/15
2,936,093	5/1960	Passalaqua	220/40 R
3,272,374	9/1966	Loveday	220/9 LG
3,319,979	5/1967	Herold	285/24
3,490,792	1/1970	Piegza	285/24

FOREIGN PATENTS OR APPLICATIONS

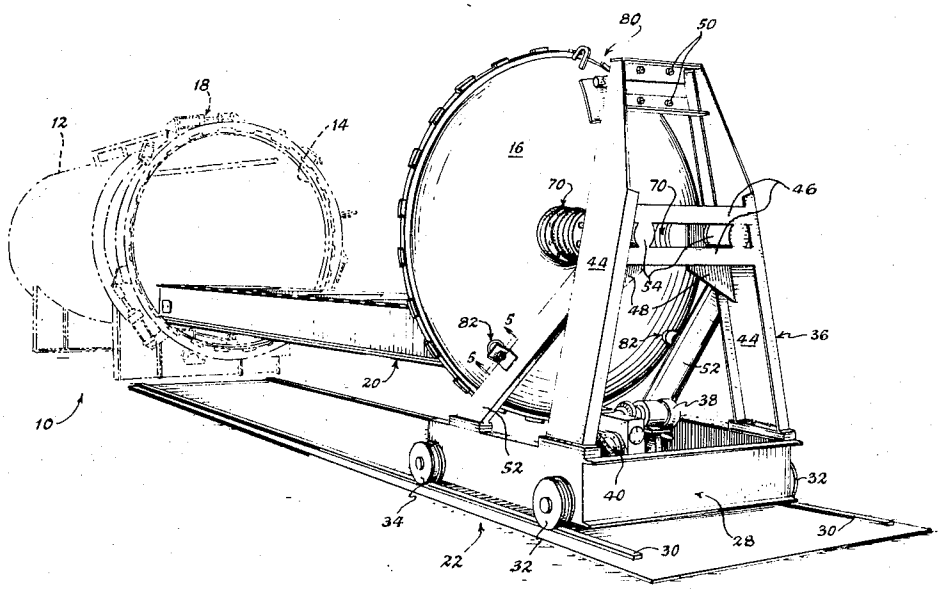
228,217	5/1960	Australia	220/40 R

Primary Examiner—George E. Lowrance
Attorney, Agent, or Firm—Bean & Bean

[57] **ABSTRACT**

The door of a horizontally disposed pressure vessel is adjustably supported by a track mounted trolley for reciprocation between door closed and opened positions. The door is provided with apertures for freely receiving trolley mounted pins, which are employed to support an outer end of a material supporting carriage movable from within the pressure vessel as the door is moved towards its opened position. The apertures are sealed by flexible metal bellows. Independent movements of the carriage and door relative to the trolley permit the door to be properly seated in a closed condition under varying carriage loading and/or pressure vessel thermal distortion conditions.

6 Claims, 5 Drawing Figures



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SHEET 1 OF 3

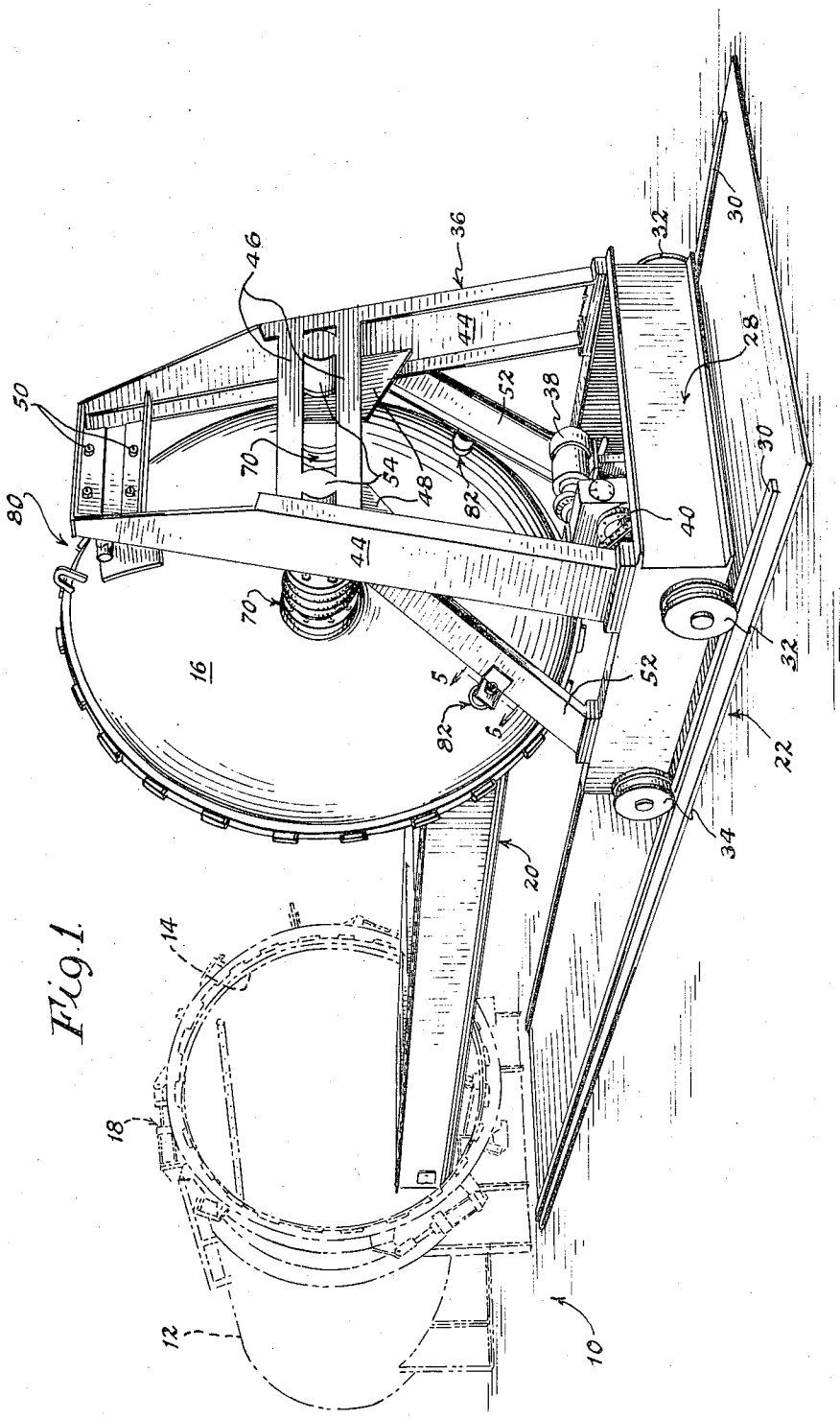


Fig. 1.

INVENTOR.
HENRY J. PIEGZA

BY

Beaut Bean
ATTORNEYS

Fig. 4.

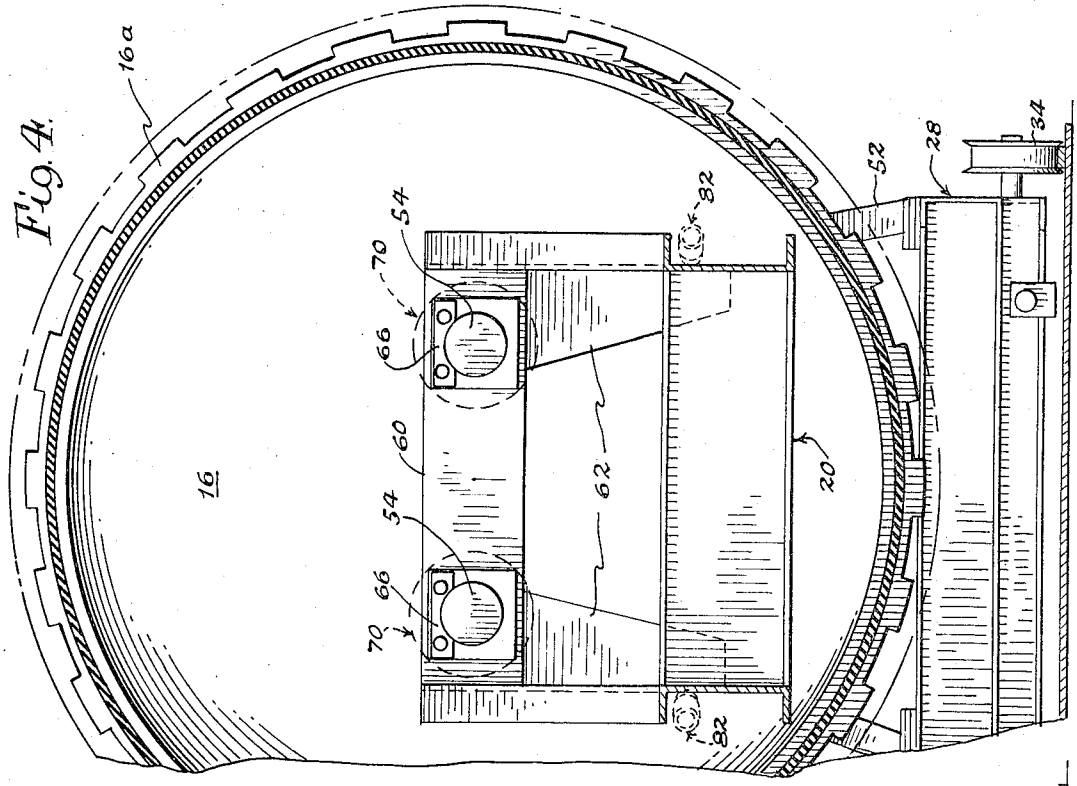
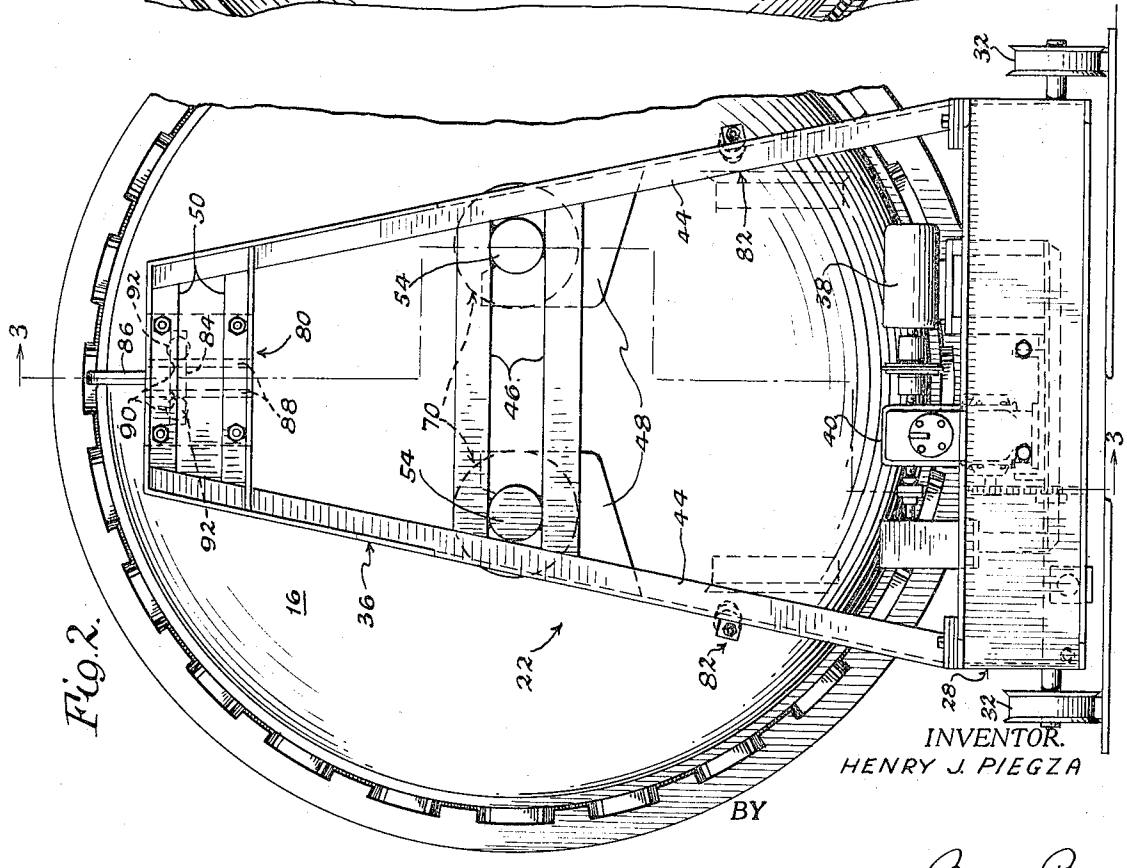


Fig. 2.



INVENTOR.
HENRY J. PIEGZA

BY

Beau & Beau
ATTORNEYS

Fig. 3.

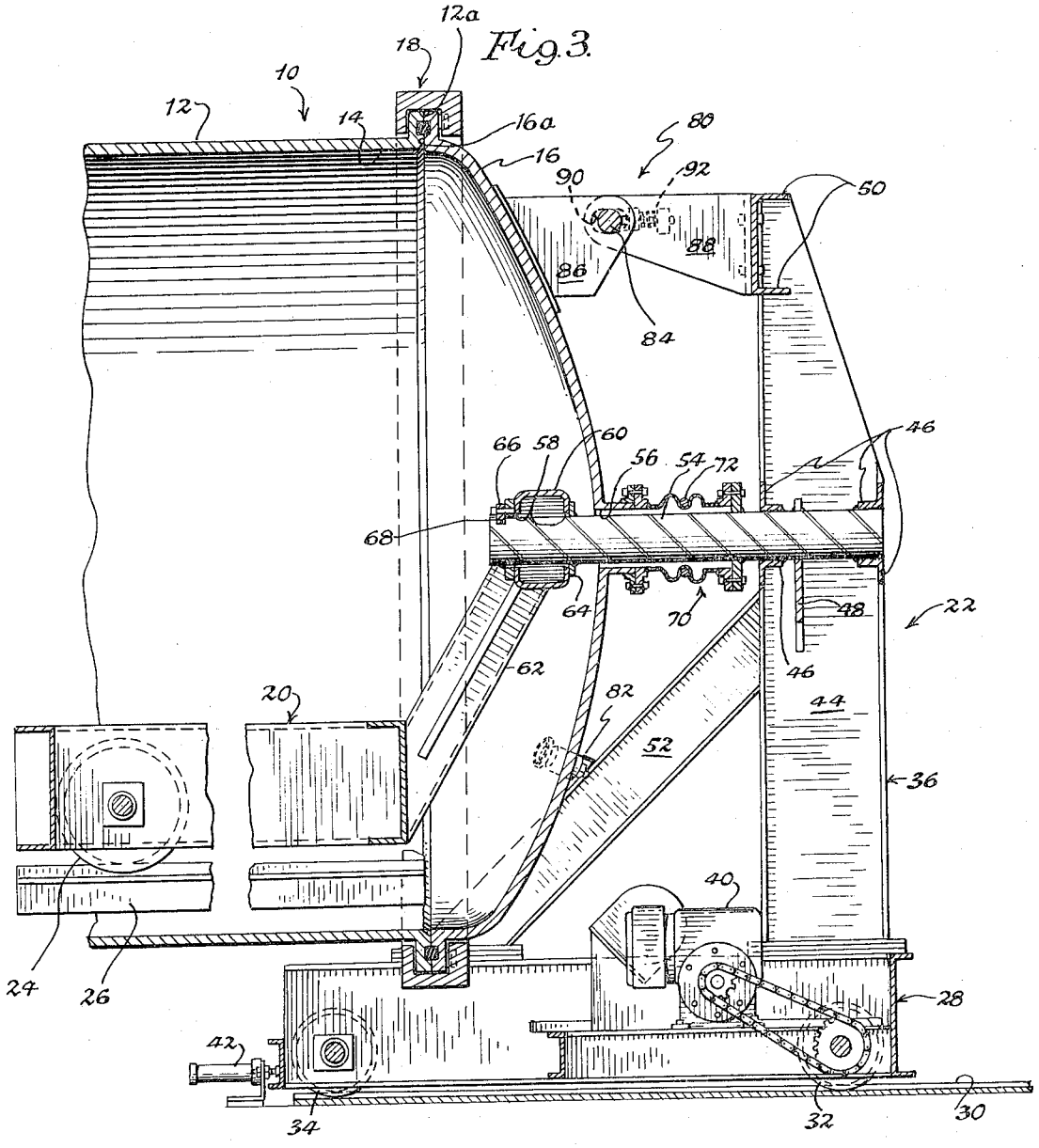
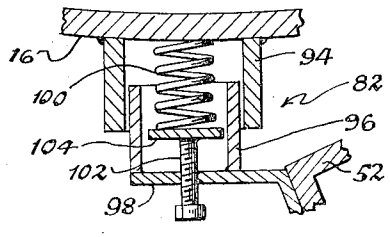


Fig. 5.



INVENTOR.
HENRY J. PIEGZA

BY

Bean & Bean
ATTORNEYS

PRESSURE VESSEL

BACKGROUND OF THE INVENTION

Heretofore, it has been proposed to mount the door of a horizontally disposed pressure vessel on a track mounted trolley for reciprocating movements between door opened and closed positions; the door being employed to support one end of a material supporting carriage such that the carriage may be automatically withdrawn from the pressure vessel as the door is opened. While this arrangement is practical for small diameter doors, it has been found to be impractical for large diameter doors and heavy carriages, since door misalignment is encountered.

SUMMARY OF THE INVENTION

The present invention is directed towards an improved pressure vessel construction in which a pressure vessel door mounting trolley may be employed to automatically withdraw a material supporting carriage from the pressure vessel as the door is opened.

In accordance with the present invention, a pressure vessel door is adjustably supported by the trolley and is formed with a pair of apertures dimensioned to freely receive a pair of pin members; the pin members serving to support the outer end of the carriage on the trolley independently of the door. Each aperture is provided with a fluid pressure seal in the form of a "flexible" metal bellows having opposite ends thereof fixed to the door and to the pins or trolley, respectively. By this arrangement, the door is free to move relative to both the carriage supporting pins and trolley as required to achieve proper seating of the door in closed position under varying carriage loading and pressure vessel thermal distortion conditions.

DRAWINGS

The nature and mode of operation of the present invention will now be more fully described in the following detailed description taken with the accompanying drawings wherein:

FIG. 1 is a perspective view of a pressure vessel embodying the present invention and illustrating the pressure vessel door in fully open position; FIG. 2 is a fragmentary front elevational view showing the pressure vessel door and trolley;

FIG. 3 is a sectional view taken generally along line 3—3 of FIG. 2;

FIG. 4 is a fragmentary rear elevational view of the pressure vessel door; and

FIG. 5 is a sectional view taken generally along line 5—5 in FIG. 1.

DETAILED DESCRIPTION

Reference is now made particularly to FIGS. 1 and 3, wherein a pressure vessel formed in accordance with the present invention is generally designated as **10.** Vessel **10** includes a horizontally disposed cylindrical shell **12** having an end access opening **14** bounded by an annular sealing surface **12***a;* a door **16** for closing opening **14** and having an annular sealing surface **16***a* engageable with surface **12***a;* a conventional rotary type locking ring mechanism **18** for releasably clamping sealing surface **16***a* in fluid pressure sealed engagement with sealing surface **12***a* after door **16** is moved into its closed position; a material supporting carriage **20** removably insertable into shell **12** through opening **14;** and a trolley **22** for supporting door **16** and the outer end of carriage **20** for reciprocating movement between door opened and closed positions. Normally, the rear end of carriage **20** would be provided with wheel or roller supports **24,** arranged to ride on rails **26** permanently fixed within shell **12,** as best shown in FIG. **3.** The specific construction of carriage **20** forms no part of the present invention and thus, may be of any desired construction.

The construction of locking ring mechanism **18** and its mode of operation by which adjacent parts (in this case shell **12** and door **16**) may be releasably locked together in a fluid sealed relationship is well known, as evidenced by my prior U.S. Pat. No. 3,490,792. Thus, it is not deemed necessary to the understanding of the present invention to again describe mechanism **18** in detail.

Trolley **22** is shown in the drawings as including a horizontally disposed, generally U-shaped base portion **28,** which is movably mounted on a pair of rails **30** by pairs of front and rear transport wheels **32** and **34,** respectively; and a standard **36,** which upstands from base portion **28** and serves to mount door **16** and the front end of carriage **20** thereon. Trolley **22** may be driven along rails **30** for the purpose of opening and closing door **16** by any suitable means, such as base portion mounted electric motor **38** coupled to one or both of front transport wheels **32** by a suitable transmission **40.** A suitable limit switch or trolley proximity sensor, such as is designated at **42** in FIG. **3,** may be employed to the deenergized motor **38** when door **16** has been moved to its closed position.

More specifically, standard **36** comprises a pair of facing, main U-shaped channel members **44,** which upstand in a converging relationship from adjacent the front end of base portion **28;** a plurality of carriage mounting angle irons **46,** which are arranged to extend transversely between channel members **44** intermediate the upper and lower ends thereof; a pair of carriage positoning plates **48** fixed one to each of channel members **44** adjacent angle irons **46;** door suspending angle irons **50,** which extend transversely between upper ends of channel members **44;** and a pair of bracing angle irons **52,** which extend downwardly from adjacent the midpoints of channel members **44** for attachment to base portion **28** adjacent the rear end thereof.

Now referring particularly to FIG. **3,** it will be seen that the front end of carriage **20** is cantilever supported on standard **36** by means of a pair of solid steel pins **54,** which are freely received within a pair of apertures **56** arranged centrally of door **16.** Specifically, the forwardly extending end of each of pins **54** is supported by and weld affixed to mounting angle irons **46** and one of plates **48,** whereas the rear end of each pin passes through aligned apertures **58** of a box-shaped channel mounting fixture **60** fixed to the front end of carriage **20** by a pair of brackets **62.** Pins **54** are clamped in place within apertures **58** by a pin mounted weldment **64** and by clamping plates **66,** which are removably received within pin recesses **68** and bolt affixed to fixture **60.**

As best shown in FIG. **3,** each of door apertures **56** is fluid pressure sealed relative to its associated pin **54** by a flexible metal bellows device **70** having its rear end affixed to door **16** peripherally of aperture **56** and its

front end affixed to pin **54** adjacent standard **36.** Preferably, a relatively inextensible band **72** is placed about the mid-portion of each of bellows devices **70** in order to prevent excessive radial expansion thereof under high pressure conditions without decreasing its flexibility.

Door **16** is shown in FIGS. **1, 2** and **3** as being mounted on standard **36** independently of pins **54** by a three point mounting or suspension, which includes an upper adjustable mounting or suspension device **80** fixed to channel members **50** and a pair of lower mounting devices **82** fixed one to each of bracing channel members **52.**

As best shown in FIGS. **2** and **3,** upper device **80** includes a pin shaft **84,** which is fixed to door mounted flange **86,** such that its axis is essentially horizontally disposed and extends generally transversely of the path of trolley reciprocation; and a pair of standard mounted brackets **88,** which are formed with aligned, horizontally elongated slots **90** for freely receiving opposite ends of pin shaft **84.** A pair of threadably adjustable spring biased devices **92** are employed to normally bias pin shaft **84** towards the rear ends of slots **90,** that is to the left as viewed in FIG. **3,** while permitting rotations and forward movement of the pin shaft within the slots as required to insure proper seating of the door in its closed position.

Lower mounting devices **82,** which accommodate for movements of pin shaft **84** within slots **90,** are each in the form of a pair of loosely fitted telescopic sleeve members **94** and **96,** which are fixed respectively to door **16** and a bracing channel mounted bracket **98.** A coil type compression spring **100,** which is arranged concentrically within members **94** and **96,** may be subject to adjustments by a threaded bolt **102,** which extends through bracket **98** and carries a spring bearing disc **104** adjacent its inwardly extending end.

Upon installation of a vessel incorporating the present invention, spring devices **92** are first adjusted to insure that pin **84** is maintained adjacent the rear ends of slots **90** when door **16** is in open position while permitting the pin to move forward and, if required, horizontally swing within the slots when the door is moved into closed, unlocked position by trolley **22;** this forward movement being at least sufficient to thereafter permit the pin to be moved towards the rear end of the slots when the door is clamped by locking ring mechanism **18** in closed, fluid pressure sealed position. Lower mounting devices **82** are adjusted to tilt door **16** vertically and/or horizontally as required to insure that the annular sealing surface **16***a* of the door is properly disposed in alignment for proper seating with the annular sealing surface **12***a* of shell **12** when the door is moved into closed position. As will be apparent, by adjustments of one or both of devices **82,** the orientation of door **16** may be modified from time to time as necessary to accommodate for vertical and/or horizontal displacements of the annular sealing surface **12***a*, which likely will occur during use, due to thermal distortions of the shell. Of course, the flexibility of bellows devices **70** permits universal and independent displacements of the door relative to pins **54,** as well as standard **36.** Such displacements additionally permit breathing, that is, in and out movements of the domed central section of the door as a result of being under vacuum or pressure conditions and/or as a result of thermally induced distortions.

In accordance with the preferred construction, variations in loadings on the carriage produce deflections of pins **54,** rather than standard **36,** and bellows device **70** are sufficiently flexible to permit such deflections to occur without influencing the previously adjusted orientation of door **16.** However, should deflections of standard **36** occur under high loading conditions, door **16** may be again properly positioned by adjustments of devices **82.**

Of course, for installations where shell **12** would not be subject to thermal distortions and/or is constrained such that movements of sealing surface **12***a* is in some manner prevented, and all carriage load induced deflections are confined to the carriage mounting pins, the above-described adjustable door mounting arrangement may be dispensed with.

I claim:

1. A pressure vessel comprising in combination:

a horizontally disposed shell having an end access opening bounded by annular sealing surface means;

a door having annular sealing surface means engageable with said shell sealing surface means for closing said access opening and having at least one aperture extending therethrough;

a carriage for supporting material to be treated within said shell, said carriage being removably insertable into said shell through said access opening;

a trolley supported for horizontal reciprocating movement relative to said access opening;

door mounting means and carriage mounting means for independently supporting said door and said carriage on said trolley;

said carriage mounting means cantilever supporting said carriage on said trolley and freely extending through said door aperture, whereby upon movement of said trolley, said carriage is removably inserted into said shell as said door is moved between access opening closed and open positions thereof; and

sealing means for providing a fluid pressure seal between said door and said carriage mounting means while permitting relative movement therebetween.

2. A vessel according to claim **1,** wherein said door mounting means is adjustable, whereby to permit adjustment of said door relative to said trolley and said carriage mounting means for positioning said door sealing surface means in alignment with said shell sealing surface means when said door is moved into said closed position thereof.

3. A vessel according to claim **1,** wherein said door mounting means includes an upper mounting device for suspending said door from said trolley and a pair of lower mounting devices, said upper mounting device including a pin shaft and slot means and resilient means, said pin shaft having an essentially horizontally disposed axis extending essentially transversely of the path of trolley reciprocation, said slot means being horizontally elongated in a direction parallel to said path and serving to rotatably and slidably support said pin shaft therewithin, said resilient means tends to bias said pin shaft relatively towards one end of said slot means while permitting rotation and sliding movement of said pin shaft relatively towards an opposite end of said slot means, and said lower mounting devices being indepen-

dently adjustable to effect rotary and/or sliding movements of said pin shaft within said slot means to position said door sealing surface means for alignment with said shell sealing surface means when said door is moved into said closed position thereof.

4. A vessel according to claim **3,** wherein said lower mounting devices each comprise a pair of loosely fitted telescopic sleeve members fixed one to each of said door and trolley, a compression spring disposed within said sleeve members and bearing adjacent opposite ends thereof on said door and said trolley, and means to adjust said spring.

5. A pressure vessel according to claim **1,** wherein said trolley comprises a base having means for supporting said trolley for said horizontal reciprocating movement and a standard upstanding from said base, said carriage mounting means is fixed to said standard intermediate upper and lower portions thereof, and said door mounting means includes an upper mounting device for movably suspending said door from adjacent said upper portion of said standard and a pair of lower moutning devices movably connecting said door with said lower portion of said standard, said lower mounting devices being independently adjustable to produce vertical and horizontal tilting movements of said door relative to said trolley and said carriage mounting means.

6. A vessel according to claim **1,** wherein said door mounting means is adjustable to produce vertical and horizontal tilting movements of said door relative to said trolley and said carriage mounting means to position said door sealing surface means for alignment with said shell sealing surface means when said door is moved into said closed position thereof.

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